AD_____

Award Number: W81XWH-10-2-0060

TITLE: Health Technology Integration for Clinical, Patient Records and Financial Management Related to the Military

PRINCIPAL INVESTIGATOR: Dr. Jeffrey Stier

CONTRACTING ORGANIZATION: Sound Shore Medical Center of Westchester
New Rochelle, NY 10601

REPORT DATE: September 2012

TYPE OF REPORT: Final

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for public release; distribution unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
01-09-2012	Final	9 AUG 2010 - 8 AUG 2012

4. TITLE AND SUBTITLE
Health Technology Integration for Clinical, Patient Records and Financial Management Related to the Military

5a. CONTRACT NUMBER

5b. GRANT NUMBER
W81XWH-10-2-0060

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Dr. Jeffrey Stier

E-Mail: jsstier@sshsw.org

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Sound Shore Medical Center of Westchester
New Rochelle, NY 10601

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for Public Release; Distribution Unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The purpose of this study is to determine the relative effectiveness of different staff training approaches for nurses regarding the usage of a newly-implemented electronic health records (EHR) system at a large hospital. The study compares the effectiveness of training that included a web-based component to a fully classroom-based program in developing knowledge of the EHR system's procedures and eventual successful utilization of the system. We examined the number of total hours of training and technical support needed to achieve proficiency with the use of the system, and the relationship between staff characteristics and the amount of follow-up support required to achieve proficiency. Our first key finding is that the substitution of a web-based component for part of the training curriculum versus only utilizing standard classroom training had no measureable effect on training outcomes. Our second key finding is that nurses with higher levels of education and general computer proficiency required fewer total hours of training and support to achieve proficiency with the EHR system. These findings suggest that the use of web-based training for some users based on an initial screening for general computer proficiency could generate substantial cost savings in large hospital systems such as military hospitals in the nationwide transition and upgrades to EHR systems.

15. SUBJECT TERMS
Electronic Health Records, EHR, Staff Training, Nurse Training, Web-Based Training, EHR Training, Health Information Technology, HIT

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			USAMRMC
U	U	U	UU	50	19b. TELEPHONE NUMBER *(include area code)*

Table of Contents

INTRODUCTION:

The purpose of Sound Shore Medical Center's (SSMC) study, entitled "Health Technology Integration for Clinical, Patient Records and Financial Management Related to the Military", is to determine the relative effectiveness of different staff training approaches for nurses regarding the usage of a newly-implemented electronic health records (EHR) system at a large hospital. Specifically, the study tested the effectiveness of two different training programs for nurses in terms of developing knowledge of the EHR system's procedures and eventual successful utilization of the system. We also examined the number of total hours of training and technical support needed to achieve proficiency with the use of the system, and the relationship between staff characteristics and the amount of follow-up support required to achieve proficiency. Prior studies have shown that information technology such as computerized provider order entry can reduce errors in medication and treatment and improve communication between clinicians (Thompson & Brailer, 2004; Rind, Safran, & Phillips, 1994). While the use of EHR systems has expanded rapidly in recent years, there have been few studies which looked at the training aspect of EHR implementation. This study has direct applications for the military as its hospitals seek to roll out or improve their EHR systems, as well as for patient care of military members or dependents who seek treatment at civilian hospitals due to travel or other situations.

BODY OF REPORT:

The accomplishments associated with each of the tasks outlined in our approved Statement of Work are as follows:

Installation of the EHR system: SSMC's EHR system, which was under development for several years in collaboration with a health information technology vendor, was rolled out for employee use in October 2011.

Development of Training Schedule: This study utilizes a randomized, two-group prospective design in which two types of initial training have been provided to our nursing staff. A list of 486 nurses employed at both SSMC and Mount Vernon Hospital was compiled and each nurse was randomly assigned (using the SPSS statistical package) to one of the groups. Group training sessions were scheduled for each participant between 8/16/2011 and 9/28/2011, with the 16-hour trainings delivered in two 8-hour sessions (two full days scheduled a week apart) for each nurse.

Creation/Testing of Online Employee Survey Participating staff members were asked to complete an online survey (titled "Employee EHR Training Survey") regarding the training that was created based on literature about employee satisfaction and proficiency surveys. Before administering our survey, we tested it with a group of "super users" who were trained on the EHR system prior to the nurses in our sample. This test was conducted in July 2011, and included 50 respondents. As no problems or issues were identified with the content of the survey, no modifications were made.

Employee Training: All of the nurses in each of the two randomly-assigned training groups received EHR training at their respective hospital sites between 8/16/2011 and 9/28/2011. Group 1 participated in a standard instructor-led, 16-hour classroom-based program, provided in small group sessions. Group 2 received a modified training program consisting of the same total number of training hours (16), with two of these hours being delivered through a web-based

training module. The total participants in each session were about twenty nurses for each training type. The training sessions were designed and delivered by the hospital's Nurse Educators using templates and materials provided by the EHR vendor. The topics covered in the two-hour web-based module were the same as in the standard classroom instruction module, covering creating, viewing and maintaining patient lists; working with alerts and flags; entering and updating patient information; working with allergies, intolerance, and adverse events; and creating clinical summaries. The remaining fourteen hours of instruction were delivered by instructors in the same manner to both groups.

Of the initial roster of 486 nurses, a total of 338 nurses received the sixteen-hour EHR training that is the subject of our study. One issue that arose during the trainings was that some of the nurses in the original sample were instead trained as "super users" who would later provide technical assistance to other nurses. In addition, some nurses failed to attend their assigned sessions due to personal or work-related schedule conflicts. Where possible, these nurses were reassigned to other sessions within their randomly-assigned training groups. However, due to scheduling constraints such as the need to keep units adequately staffed, 38 nurses did not receive the appropriate training for their assigned group as a result of these absences. These participants were therefore dropped from the analysis. Since the selected EHR system is focused on inpatients, nurses in the Outpatient Department and Operating Room at SSMC did not receive the full 16 hours of training. These individuals were also dropped from the analysis. The remaining group of 291 nurses (who successfully completed their assigned training course) constitutes the sample that is used in our analysis.

Despite the attrition rate from the initial sample, we believe that the random assignment process produced roughly equivalent training groups and that they remain roughly equivalent. The characteristics of the nurses in each of the two training groups are shown in the table below. Each group is similar in terms of age, experience, and length of employment at the hospital, as well as in terms of education level. None of the differences between the two groups is statistically significant at the 5% level. However, in one category, the percentage of nurses with a Master's degree, the difference is significant at the 10% level. This may be the result of the attrition issue described above as well as the low overall percentage of participants with this level of education.

Table 1: Baseline Characteristics of Randomly-Assigned Training Groups

	Training Group 1		*Training Group 2*		
	N	Mean (Standard Deviation)	N	Mean (Standard Deviation)	Sig. (2-tailed)
Age	135	48.41 (10.68)	156	49.67 (11.31)	.965
Percent Female	135	.926 (.263)	156	.936 (.246)	.504
Percent w/Master's degree	135	.044* (.207)	156	.071* (.257)	.058
Years of experience	135	16.24 (10.16)	153	17.67 (11.47)	.201
Years employed at SSMC/MVH	134	13.03 (10.16)	155	14.15 (11.42)	.127

***Denotes 1% significance level; ** denotes 5% significance level; * denotes 10% significance level.

At the beginning of the first training session, all participants were asked to complete a short survey regarding their general level of proficiency with computers as well as their past experience with EHR systems. Selected results from this survey are presented below. Most participants use computers at home, and nearly half had at least some prior experience with EHR systems. The majority reported fairly frequent (daily or several times per week) computer usage, with about half using computers on a daily basis. Most participants also rated their general computer skills as average or above average, with only about 7% giving themselves the lowest

skill rating. The results of the initial proficiency were matched with measures of subsequent, post-training proficiency with the EHR system.

Table 2: Initial Proficiency Survey Results (N=338)

Question	**Yes**	**No**
Have you ever received training in the use of an Electronic Health Records system?	42.9%	55.0%
Have you ever used an Electronic Health Records system to record information regarding patient care?	46.0%	51.9%
Do you currently use computers as part of your work in the hospital?	87.6%	10.3%
Do you use a computer at home?	82.4%	14.5%
Do you have access to the internet at home?	89.7%	7.2%

How often do you use computers, including at work and at home (please choose the answer that is closest to the frequency of your computer usage)?

Frequency	**Percent**
Daily	50.4%
Several times per week	26.1%
Once per week	13.4%
Once per month	4.4%
Never	2.6%

On a scale of 1 to 5, (with 1 being not sure how to turn a computer on, and 5 being very good), how would you rate your computer skills?

Response	Percent
1	7.2%
2	14.2%
3	33.1%
4	23.8%
5	18.6%

The Initial Proficiency Survey was completed by each nurse through a web-based form at the beginning of their training session. Each nurse was asked to enter their ID code at the beginning of the survey. As a result of mismatches between these self-reported ID codes and the codes in other datasets containing nurse demographics and scores on the proficiency measures, the initial proficiency measures were available for a subset of 237 of the sample. A comparison of the initial proficiency measures of each training group is shown in Table 3 below. Independent samples t-tests showed no statistically significant differences between the two groups on any of the key measures from the survey.

Table 3: Initial Computer Proficiency and Experience by Training Group

	Training Group 1		*Training Group 2*		
	N	Mean (Standard Deviation)	N	Mean (Standard Deviation)	Sig. (2-tailed)
Percentage w/prior EHR training	116	.43 (.50)	121	.48 (.50)	.458
Percentage w/ 1 year+ EHR experience	116	.45 (.50)	121	.50 (.50)	.465
Percentage using computers at work	116	.91 (.28)	121	.88 (.32)	.454
Percentage using computers at home	116	.86 (.35)	121	.82 (.39)	.359
Percentage w/internet access at home	116	.92 (.27)	121	.92 (.28)	.887
Percentage using computers daily	116	.55 (.50)	121	.48 (.50)	.267

***Denotes 1% significance level; ** denotes 5% significance level; * denotes 10% significance level.

Proficiency Testing At the conclusion of the training sessions, each participant completed a three-part assessment of knowledge of and/or proficiency with the EHR system. Part 1 of the

post-training assessment consisted of a 20-question written multiple choice test (developed with the assistance of the vendor providing the EHR system) designed to measure knowledge of the EHR system's procedures. Part 2 of the post-training assessment involved completing a series of tasks within the EHR system while being observed by an instructor, with points recorded by the instructor for each task completed successfully. Finally, each participant's proficiency with the actual use of the system after the "go-live" implementation date was assessed by their supervisor or a Nurse Educator using a 27-item observational protocol, with each item rated on a five-point scale The number of nurses for whom a score was available on each measure varies, as not all nurses completed all of the assessments, and there were some issues with matching ID codes for Part 1 as this test was delivered through a web-based form in which nurses entered their own (and sometimes incorrect) ID codes.

While these instruments had not been validated to establish the relationship between test scores and proficiency with the use of the EHR system, the items tested include basic system procedures that are necessary to achieve proficient use of the system. We chose to employ the three different approaches to measuring proficiency – a written test, a practical exam, and an observational rating by a supervisor – in part due to the lack of availability of existing, validated instruments in the hope of showing consistency between the measures. Table 4 shows the correlations between each of the measures as well as between each measure and the amount of follow-up training needed. Part 2 (in which EHR tasks were completed and scored by an instructor) is most likely the best measure of proficiency of the three as it is positively correlated with both of the other assessments, and negatively correlated with the number of minutes of follow-up required (in other words, higher scores were associated with fewer minutes of follow-up training).

Table 4: Correlations - Proficiency Scores and Minutes of Follow-up

		Part 1 Score	Part 2 Score	Supervisor Rating	Minutes of Follow-up
Part 1 Score	Pearson Correlation	1	.226**	.127	-.117
	Sig. (2-tailed)		.001	.065	.073
	N	235	230	214	235
Part 2 Score	Pearson Correlation	.226**	1	.420**	-.131*
	Sig. (2-tailed)	.001		.000	.029
	N	230	279	252	279
Supervisor Rating	Pearson Correlation	.127	.420**	1	-.122
	Sig. (2-tailed)	.065	.000		.050
	N	214	252	257	257
Minutes of Follow-up	Pearson Correlation	-.117	-.131*	-.122	1
	Sig. (2-tailed)	.073	.029	.050	
	N	235	279	257	289

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

The differences in the proficiency scores between the training groups were examined as part of the test of our hypothesis that nurses who receive web-based training as a substitute for part of the classroom-based training will show higher initial levels of knowledge of EHR system procedures. The results of our analysis of the proficiency test scores are presented below in the section titled “Results of Final Data Analysis”.

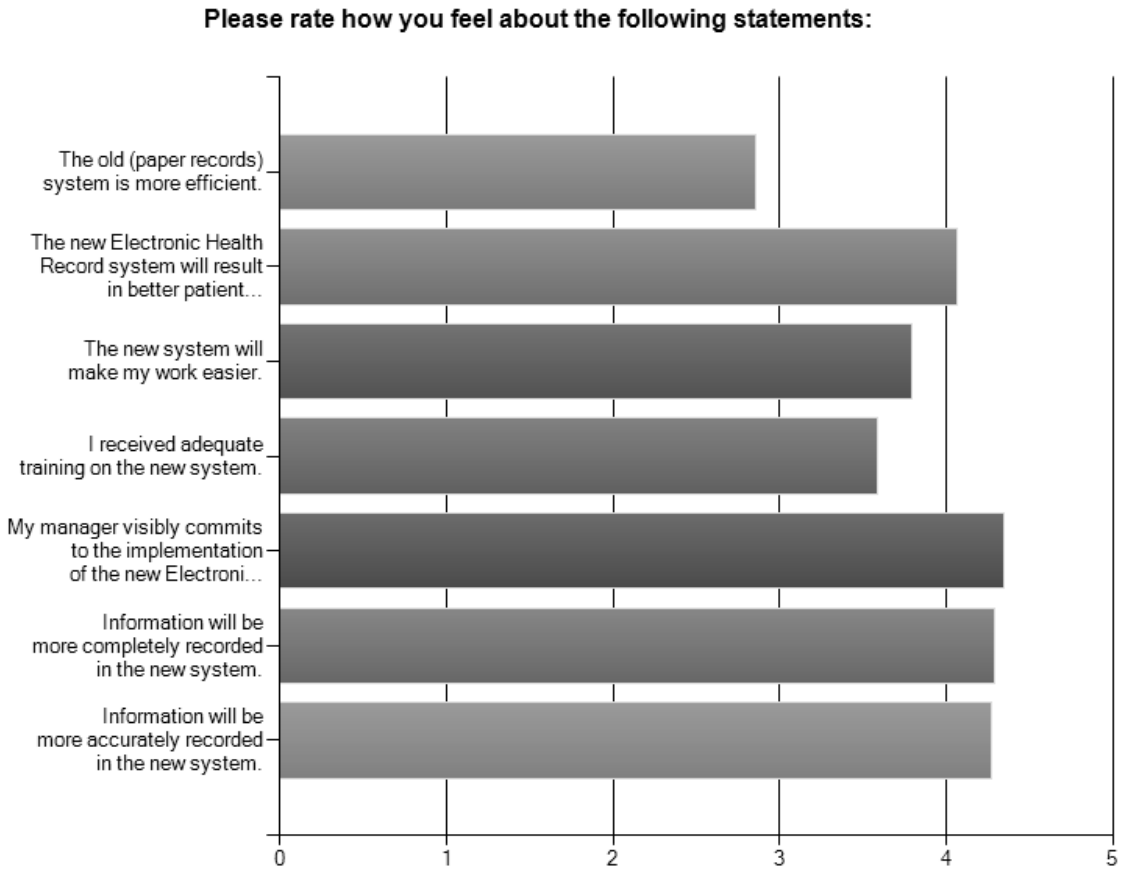
Deployment/Administration of Online Survey The tables below present some of the key results from a post-training anonymous survey of participants regarding their satisfaction with the training. Since this survey was anonymous, these results cannot be linked to the proficiency scores or other measures but do give us some insight into how participants felt about the effectiveness of the training. The Employee EHR Training Survey was initially deployed in July 2011 for testing with an initial group of “super users” who received more extensive training on the EHR system than the nurses in our sample. Each nurse in our study sample was then asked to complete the Employee EHR Training Survey at the end of their last training session. The total number of respondents is higher than the number of participants in our score analysis, as this survey was taken by trainees who were subsequently dropped from the analysis due to the reasons outlined previously (because they were supervisors, missed the assigned training, etc.). Overall, the nurses seem to be fairly positive about the utility of the new system, but somewhat more ambivalent about their readiness to use the system immediately post-training. Items which involved rating statements about the effectiveness of the system, such as whether it would improve patient outcomes and the accuracy of information tracking, were rated highly (averaging greater than 4 out of 5). However, only about half of respondents felt that they were ready to use the new EHR system immediately after training, and only about 7% reported being “very comfortable” with the system at the end of the training. It should be noted that this survey was administered immediately after the training sessions and before the nurses began actually using the system, so these are initial reactions following the 16-hour training session.

Table 5: Responses to anonymous post-training satisfaction survey

Did part of your training involve web based training?		
Answer Options	**Response Percent**	**Response Count**
Yes	58.0%	221
No	42.0%	160
Total		**381**

How comfortable are you with the new system after the training?		
Answer Options	**Response Percent**	**Response Count**
Very comfortable	7.3%	28
Somewhat comfortable	69.0%	263
Not at all comfortable	23.6%	90
Total		**381**

I feel ready to use the new Electronic Health Record system.		
Answer Options	**Response Percent**	**Response Count**
Yes	50.7%	189
No	49.3%	184
Total		**373**



The rating scale for the above questions is as follows:

1 =“Definitely Not”
2 =“Maybe Not”
3=“Not Sure”
4=“Maybe”
5=“Definitely”

Table 6 shows a set of bivariate correlations between self-reported personal characteristics of respondents and their level of satisfaction with the EHR training and perceived readiness to begin using the EHR system. Satisfaction with the training was measured using a five point rating scale; perceived readiness to begin using the system was measured through two yes/no questions. Increasing age was associated with both lower levels of satisfaction with the training

Table 6: Anonymous Survey: Correlations – Nurse Characteristics, Satisfaction with Training, Readiness

		Age:	Masters	English	In your opinion, how good are your computer skills? (Scale, 1-5)	Have you ever used an electronic health records system in another job?	I received adequate training on the new system.	I feel ready to use the new Electronic Health Record system.	How comfortable are you with the new system after the training? (Scale, 1-3)
Age	Pearson Correlation	1	.006	-.161**	-.471**	-.177**	-.183**	-.152**	-.207**
	Sig. (2-tailed)		.920	.003	.000	.001	.001	.007	.000
	N	338	338	338	334	334	318	318	325
Masters or Above	Pearson Correlation	.006	1	.123*	.094	.103	-.083	.014	.101
	Sig. (2-tailed)	.920		.024	.086	.060	.138	.802	.070
	N	338	338	338	334	334	318	318	325
Native English Speaker	Pearson Correlation	-.161**	.123*	1	.178**	.051	-.128*	-.015	.039
	Sig. (2-tailed)	.003	.024		.001	.349	.022	.796	.481
	N	338	338	338	334	334	318	318	325
In your opinion, how good are your computer skills? (Scale, 1-5)	Pearson Correlation	-.471**	.094	.178**	1	.322**	.118*	.255**	.318**
	Sig. (2-tailed)	.000	.086	.001		.000	.036	.000	.000
	N	334	334	334	334	334	318	318	325
Have you ever used an electronic health records system in another job?	Pearson Correlation	-.177**	.103	.051	.322**	1	.052	.291**	.243**
	Sig. (2-tailed)	.001	.060	.349	.000		.353	.000	.000
	N	334	334	334	334	334	318	318	325
I received adequate training on the new system.	Pearson Correlation	-.183**	-.083	-.128*	.118*	.052	1	.407**	.452**
	Sig. (2-tailed)	.001	.138	.022	.036	.353		.000	.000
	N	318	318	318	318	318	318	318	318
I feel ready to use the new Electronic Health Record system.	Pearson Correlation	-.152**	.014	-.015	.255**	.291**	.407**	1	.469**
	Sig. (2-tailed)	.007	.802	.796	.000	.000	.000		.000
	N	318	318	318	318	318	318	318	318
How comfortable are you with the new system after the training? (Scale, 1-3)	Pearson Correlation	-.207**	.101	.039	.318**	.243**	.452**	.469**	1
	Sig. (2-tailed)	.000	.070	.481	.000	.000	.000	.000	
	N	325	325	325	325	325	318	318	325

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

and lower perceived readiness. Higher levels of self-reported computer skills as measured by a five-point scale were associated with higher levels of both satisfaction and perceived readiness. Previous EHR experience was not associated with differences in satisfaction with the training but was associated with higher levels of perceived readiness to use the system. Education level, as measured by reporting having a Master's degree or above, was not associated with either satisfaction or perceived readiness to use the system. Being a native English speaker was associated with lower levels of satisfaction with the training but was not associated with the measures of perceived readiness to use the system.

The survey results also show variations in perceived readiness to use the new EHR system between the group that received the web-based training component and the group receiving only the traditional instructor-led approach. As shown in Table 7, about 55% of survey respondents who reported participating in the web-based component indicated that they felt ready to use the new EHR system, versus 41% of those who reported participating only in the traditional training. However, both groups reported similar ratings of satisfaction with their training program, averaging 3.58 and 3.49 respectively on the five-point rating scale. It should be noted that since this survey was anonymous, these results rely on self-reported participation in each of the training groups as opposed to the actual random assignments used in the other parts of the study.

Finally, the anonymous survey included an open-ended question regarding how the training program could be improved ("How could the training be improved to enable you to learn more about the electronic medical record system?"). The most common response by far was some variation on "more practice" or "more hands-on time". Among the 188 non-"super users" who answered this question, 65 responses fell into this category. For the same group, 39 responded with "more training time" or a similar phrase, the next most common response. Other responses were not as frequent and thus were not as easily categorized, with most being expressed by only one individual or a handful of individuals. A few respondents stated that the training should be "unit specific" as opposed to mixing nurses from different units. Some suggested that the trainees should be grouped by ability level, and that there should be additional trainers in each session. Only a small number commented on the web-based component, with four respondents suggesting that it should be eliminated, while three suggested that it should be expanded.

Table 7: Perceived Post-Training Readiness to Use New EHR System by Training Group

	Web-based training		*Traditional training only*		
	N	Mean (Standard Deviation)	N	Mean (Standard Deviation)	Sig. (2-tailed)
I feel ready to use the new Electronic Health Record System (Yes/No)	189	.55** (.499)	129	.41** (.494)	.015

NOTE: This table excludes "super users"
***Denotes 1% significance level; ** denotes 5% significance level; * denotes 10% significance level.

Collection of Samples of System Usage Data: Our original plan called for collection of an additional proficiency measure, based on randomly sampling five patient records for each participant at the conclusion of the training period and determining if a list of critical items was successfully completed within each record. Our preliminary discussions with our EHR vendor during the planning of the project had led us to believe that this was feasible. However, as we moved to implement this measure we were told by the vendor that the way the system is structured that this is not possible. Data entry errors are flagged immediately by the system and will generally not allow the record to be saved; they system does not record these errors and cannot be modified by the vendor to produce this information. We were therefore forced to abandon the use of data-entry errors as a performance measure. As an alternative measure of competency, we developed a structured assessment based on a 27-item observational protocol administered by a member of the nursing department, such as a nursing director, manager, or educator. Each nurse was asked to demonstrate skills and to articulate the purpose or reason for specific information that must be entered into the system. The knowledge and skills that were selected for assessment are necessary to ensure that a valid EHR is created for each patient.

Interim Data Analysis/Interim Evaluation Report: The interim data analysis described in our Statement of Work was submitted as our Annual Report in October 2011. The information in the interim data analysis is incorporated in this report.

Results of Final Data Analysis: This section presents the final results our analysis the data collected relative to our hypotheses and specific research questions. The main goals of our project were to test two different approaches to staff training for registered nurses on levels of knowledge regarding the usage of a new Electronic Health Record (EHR) system, as well as to determine the total number of training and support hours needed to achieve proficiency with the EHR system. Therefore, the hypotheses tested are as follows:

- Registered Nurses who receive web-based training in addition to classroom-based training will show higher initial levels of knowledge of EHR system procedures.

- Registered Nurses with different personal characteristics (age, years of formal education, native language, use of a computer at home) will require different levels of subsequent training and technical support in order to achieve proficiency and comfort using the new Electronic Health Record system. We expect users with higher levels of formal education, who speak English as a native language, and/or have higher prior levels of computer proficiency to require the fewest total hours of training and support to achieve proficiency with the use of the new EHR system.

Our specific research questions are as follows:

1. Does a training plan that includes a web-based component as well as classroom-based training result in higher initial levels of knowledge regarding use of the EHR system for nurses than a classroom-only plan of the same duration?

2. How many hours of training and technical support are required for nurses to achieve proficiency in the use of the EHR system?

3. Are personal characteristics (age, job type, gender, prior computer literacy) related to the amount of training/technical support needed to achieve proficiency with the EHR system? Do these characteristics affect satisfaction with the new EHR system?

<u>Findings Regarding Web-Based vs. Traditional Training Model on Training Outcomes</u>
The following tables show the average test scores by training group for each of the three proficiency measures. Part 1 of the post-training assessment was a 20-question written multiple choice test. Part 2 of the post-training assessment involved completing a series of tasks within the EHR system, with points recorded by the instructor for each task completed successfully. Finally, each participant's proficiency with the actual use of the system after the "go-live" implementation date was assessed by their supervisor or a Nurse Educator using a 27-item observational protocol, with each item rated on a five-point scale.

Table 8: Post-Training Assessment - Part 1 (Maximum possible score - 40 points)

	Training Group 1		*Training Group 2*		
	N	Mean (Standard Deviation)	N	Mean (Standard Deviation)	Sig. (2-tailed)
Part 1 Score	108	26.48 (4.33)	127	25.97 (4.22)	.360

Highest score=34; lowest score=10.
***Denotes 1% significance level; ** denotes 5% significance level; * denotes 10% significance level.

Table 9: Post Training Assessment-Part 2 (Maximum possible score - 60 points)

	Training Group 1		*Training Group 2*		
	N	Mean (Standard Deviation)	N	Mean (Standard Deviation)	Sig. (2-tailed)
Part 2 Score	137	52.15 (9.97)	142	53.42 (11.44)	.322

Highest score=60; lowest score=0.
***Denotes 1% significance level; ** denotes 5% significance level; * denotes 10% significance level.

Table 10: Post Training Assessment - Supervisor Proficiency Rating (Maximum possible score - 135 points)

	Training Group 1		*Training Group 2*		
	N	Mean (Standard Deviation)	N	Mean (Standard Deviation)	Sig. (2-tailed)
Supervisor Rating Score	129	122.16 (13.65)	128	122.12 (16.79)	.981

Highest score=135; lowest score=54.
***Denotes 1% significance level; ** denotes 5% significance level; * denotes 10% significance level.

As the tables show, the two groups received very similar scores on each assessment. The number of nurses for whom a score was available on each measure varies, as not all nurses completed all of the assessments. Based on independent samples t-tests, there are no statistically significant differences between the groups on any of the three scores. These findings did not support our hypothesis that nurses who receive web-based training as a substitute for part of the classroom-based training will show higher initial levels of knowledge of EHR system procedures. However, it should be noted that this change in the training model produced essentially the same results as the fully classroom-based model, which may have implications regarding reducing overall training costs as discussed in the Conclusions section below.

Findings Regarding Level of Training/Technical Support Needed

The level of additional training and technical support needed by each nurse was determined by recording the number of minutes of such assistance provided to each individual after the new EHR system was placed into service. For a two-week period following beginning at the point at which the system "went live" throughout both hospitals, each nursing supervisor as well as a set of roving trainers were instructed to record the time spent on assisting each nurse with the use of the new system. These contacts were recorded on paper rosters containing each nurse's name, the number of minutes of assistance provided, the date, and the nurse's unit within the hospital. Administrators later added identification codes to each record, removed the names, and forwarded the data to the researchers.

Table 11 below summarizes this follow-up assistance data. The average number of minutes of follow-up training provided to all members of the sample was 53 minutes; however, there was a great deal of individual variation in the number of minutes provided. About half of the participants showed no subsequent training contacts, while a few had several hours of additional training over this period.

Table 11: Follow-up Training/Technical Assistance Provided

Number of Contacts Recorded	563
Average Number of Minutes per Contact (Standard Deviation)	27.24 (34.05)
Minimum number of minutes in a single contact	1
Maximum number of minutes in a single contact	240
Unique individuals receiving assistance (Percentage of sample, N=289)	145 (50%)
Average number of minutes of assistance per individual for entire sample (including those receiving no assistance)	53
Average number of contacts per individual among nurses receiving assistance	4
Average total minutes of assistance per individual only among nurses receiving assistance	106
Maximum number of contacts provided to an individual	26

Maximum number of minutes provided to an individual	550

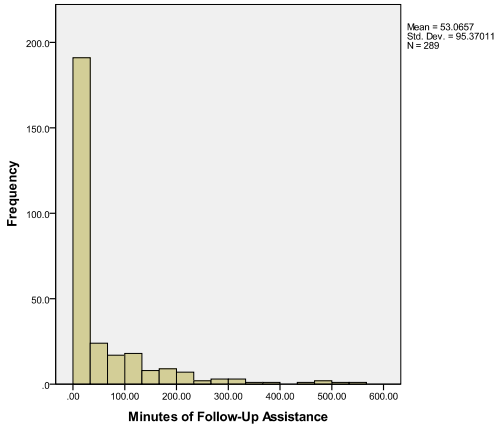
Table 12: Average Number of Minutes of Follow-up Assistance by Group

	Training Group 1		*Training Group 2*		
	N	Mean (Standard Deviation)	N	Mean (Standard Deviation)	Sig. (2-tailed)
Minutes of Follow-up	143	48.97 (92.94)	146	57.08 (97.84)	.471

***Denotes 1% significance level; ** denotes 5% significance level; * denotes 10% significance level.

Applying an independent samples t-test to the above data (Table 12) shows no statistically significant difference in the mean number of minutes of follow-up assistance provided to each group. However, it is likely that this standard approach is not advisable in this situation as the dependent variable (minutes of assistance provided) is not normally distributed, thereby violating one of the key assumptions for the use of a t-test. The distribution of the dependent variable is shown in Table 13. An alternative approach to modeling this type of count data – in which many cases have a value of zero due to the absence of the event being counted – is to employ Poisson or negative-binomial distributions, which may provide a better fit to the data. Therefore, as a further check, bivariate Poisson and negative-binomial regressions were estimated with training group as a binary predictor and the number of minutes of follow-up as the dependent variable. The Poisson model indicated a statistically -significant difference between the two groups, but was a poor fit to the data as there was evidence of overdispersion. The negative binomial model was indicated to be a better fit but showed no statistically significant difference between the groups. Taken as a whole, these tests indicate that there is likely to be no meaningful difference in the amount of follow-up assistance provided to each group.

Table 13: Distribution of Minutes of Follow-up Assistance Provided



Findings Regarding Relationships Between Nurse Characteristics and Training Needs

The relationships between the characteristics of the nurses and the amount of subsequent assistance needed after the initial training was explored through simple bivariate correlations as well as through regression analysis. Table 14 shows the correlations between the number of minutes of follow-up training required and the available nurse characteristics. The correlation between age and the number of minutes of follow-up is statistically significant and positive – on average, as age increases so does the amount of follow-up provided. Two other variables – the scale measuring self-reported computer skills and the indicator variable for daily computer use in any setting – show statistically-significant negative correlations. In other words, as self-reported skill levels increase, the number of minutes of follow-up assistance decreases; and nurses who reported daily use of a computer prior to the implementation of the EHR system required fewer minutes of follow-up assistance than those who did not. Considered in isolation, several other potential predictors – educational level (holding a masters degree), prior EHR experience, and use of computers at work or at home were not significantly correlated with the amount of follow-up needed.

TABLE 14: Correlations – Nurse Characteristics and Minutes of Follow-up

		Female	Age	Masters or higher	Previous EHR Train	EHR Exp	Use computer/work	Use computer/home	Use computer daily	Self-rated computer skills (1-5)	Minutes of follow-up
Female	Pearson Correlation	1	.065	.068	-.006	-.032	-.029	-.070	-.148*	-.100	.129*
	Sig. (2-tailed)		.277	.256	.923	.624	.662	.293	.025	.131	.031
	N	281	281	281	231	231	231	231	231	230	281
Age	Pearson Correlation	.065	1	-.005	-.230**	-.230**	-.008	-.313**	-.276**	-.396**	.135*
	Sig. (2-tailed)	.277		.931	.000	.000	.908	.000	.000	.000	.024
	N	281	281	281	231	231	231	231	231	230	281
Masters or higher	Pearson Correlation	.068	-.005	1	-.057	-.065	.013	.051	.147*	.125	-.054
	Sig. (2-tailed)	.256	.931		.389	.326	.848	.438	.025	.059	.369
	N	281	281	281	231	231	231	231	231	230	281
Previous EHR Train	Pearson Correlation	-.006	-.230**	-.057	1	.882**	.139*	.169**	.159*	.290**	-.059
	Sig. (2-tailed)	.923	.000	.389		.000	.033	.009	.014	.000	.362
	N	231	231	231	237	237	237	237	237	236	237
EHR Exp	Pearson Correlation	-.032	-.230**	-.065	.882**	1	.178**	.137*	.158*	.274**	-.054
	Sig. (2-tailed)	.624	.000	.326	.000		.006	.035	.015	.000	.405
	N	231	231	231	237	237	237	237	237	236	237
Use computer/work	Pearson Correlation	-.029	-.008	.013	.139*	.178**	1	.158*	.066	.127	-.084
	Sig. (2-tailed)	.662	.908	.848	.033	.006		.015	.312	.051	.195
	N	231	231	231	237	237	237	237	237	236	237
Use computer/home	Pearson Correlation	-.070	-.313**	.051	.169**	.137*	.158*	1	.243**	.488**	-.016
	Sig. (2-tailed)	.293	.000	.438	.009	.035	.015		.000	.000	.811
	N	231	231	231	237	237	237	237	237	236	237
Use computer daily	Pearson Correlation	-.148*	-.276**	.147*	.159*	.158*	.066	.243**	1	.433**	-.212**
	Sig. (2-tailed)	.025	.000	.025	.014	.015	.312	.000		.000	.001
	N	231	231	231	237	237	237	237	237	236	237
Self-rated computer skills (1-5)	Pearson Correlation	-.100	-.396**	.125	.290**	.274**	.127	.488**	.433**	1	-.175**
	Sig. (2-tailed)	.131	.000	.059	.000	.000	.051	.000	.000		.007
	N	230	230	230	236	236	236	236	236	236	236
Minutes of follow-up	Pearson Correlation	.129*	.135*	-.054	-.059	-.054	-.084	-.016	-.212**	-.175**	1
	Sig. (2-tailed)	.031	.024	.369	.362	.405	.195	.811	.001	.007	
	N	281	281	281	237	237	237	237	237	236	289

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

A set of negative-binomial regression models was employed to further explore these relationships. Table 15 provides descriptive information for the regression variables, while Table 16 shows the results. As discussed in the previous section, the distribution of the variable containing the number of minutes of follow-up assistance provided to each participant is not normally distributed, but is skewed to the right and is characterized by a large percentage of cases with values of zero (as many nurses did not require additional training beyond the initial sessions). For this type of dependent variable, Poisson or negative-binomial models should be more appropriate than the OLS regression models that are more commonly employed, as a key assumption for OLS regression is that the dependent variable should be normally distributed (Berk & MacDonald, 2007; McElduff et al, 2010) . In this case, since the variance in the dependent variable is greater than the mean, the negative binomial models should provide a better fit than the Poisson models. This was supported by the diagnostic statistics for each model, which showed a better fit for negative binomial models.

An issue with the selection of predictors for these models is the potential problem with multicollinearity among some of the available characteristics. For example, age, years of experience, and years of employment at the hospital are all related. Several of the available measures of computer skills (daily computer use, self-reported computer skills, and previous EHR experience) are also fairly strongly correlated. Therefore, these models use only one of the variables from each of these areas.

The basic regression model can be expressed as follows:

$$\text{TRAIN} = c + a\,\text{GENDER} + b\,\text{AGE} + d\,\text{EDUC} + f\,\text{EHR} + g\,\text{COMP} + e$$

Where TRAIN is the total number of minutes of follow-up assistance provided to an individual nurse; GENDER is an indicator variable for female; AGE is the age in years of the nurse; EDUC is an indicator variable for holding a Masters degree or higher; EHR is an indicator variable for whether the nurse has previous experience with EHR systems; and COMP is an indicator variable for whether or not the nurse reported using a computer on a daily basis. In a variation of this model, a variable consisting of self-rated general computer proficiency on a scale of 1-5 was substituted for the COMP variable. The letter *c* is a constant term to be estimated by regression, and *e* is a random error term. The letters *a*, *b*, *d*, *f*, and *g* are coefficients to be estimated.

Table 15: Summary of Regression Variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Minutes of Follow-up Assistance Provided	289	0	550	53.07	95.37
Gender (1=Female)	281	0	1	.93	.26
Age (Years)	281	23	76	48.79	10.80
Education (1=Masters or higher)	281	0	1	.06	.23
EHR Experience (1=Yes)	237	0	1	.47	.50

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Use Computer Daily (1=Yes)	237	0	1	.51	.50
Self-rated computer proficiency (scale of 1-5)	236	1	5	3.28	1.19
Valid N (Listwise)	230				

Table 16: Regression Results – Dependent Variable: Minutes of Follow-up Assistance

Independent Variable	Coefficient (Standard Error)			
	Model 1	*Model 2*	*Model 3*	*Model 4*
Gender (1=Female)	1.739*** (.3973)	1.976*** (.2858)	1.731*** (.2929)	1.925*** (.2874)
Age (Years)	.016** (.0052)	.020*** (.0059)	.013** (.0062)	.009 (.0064)
Education (1=Masters or higher)	-.571*** (.2620)	-.839*** (.3117)	-.698** (.3138)	-.840*** (.3116)
EHR Experience (1=Yes)	--	-.267* (.1385)	-.219 (.1397)	-.080 (.1445)
Use Computer Daily (1=Yes)	--	—	-.567*** (1426)	—
Proficiency scale (1-5)	--	—	--	-.269*** (.0669)
Number of Cases	281	231	231	230
Log Likelihood	-1374.782	-1131.903	-1124.035	-1115.714

***Denotes 1% significance level; ** denotes 5% significance level; * denotes 10% significance level.

The results from negative-binomial models are somewhat more difficult to interpret than those from OLS regressions because the coefficients on each predictor represent rate ratios, which estimate the change in the relative (rather than absolute) mean number of events between the groups rather than the difference in means between the groups. However, the signs on the significant coefficients indicate whether each predictor was associated with a positive or negative increase in the number of minutes of follow-up required by each nurse.

In all of the models, being female was associated with higher levels of follow-up, as the indicator variable for female is significant and positive in each model. It should be noted that since the overwhelming majority of the sample was female this may have influenced this finding. The education (Masters or higher) indicator is also significant in all of the models and is negative, so it is associated with lower levels of follow-up training. Prior EHR experience is significant and negative (indicating lower training needs) until controls are added for prior level of computer skills. Age is also significant and positive in all but one model, indicating the need for increasing follow-up training with increasing age. Both of the measures of pre-training computer skills – the indicator for daily computer use and self-rated computer skills – are significant and negative, indicating that initial levels of general computer literacy (as opposed to specific EHR experience) are associated with lower levels of follow-up, even when controlling for other factors such as age and education level.

Overall, these results support our hypothesis that nurses with different personal characteristics require different levels of subsequent training and technical support in order to achieve EHR proficiency, and that nurses with higher levels of education and general computer proficiency will require fewer total hours of training and support. On a practical level, the most consistent predictors studied that could be used to guide the design of training programs seem to be daily computer use and self-reported computer skill level. Both of these predictors were statistically significant and negative (indicating less follow-up) in the bivariate correlations and in the multivariate models, suggesting that either could be used on its own to help identify users who are likely to need less intense training.

Interviews with Nurse Educators and "Super Users": Given the dearth of practical information available regarding the design and implementation of EHR training, the researchers conducted a series of informal interviews with nurse training and technical staff to explore the issues encountered during the training process. The findings of this effort are meant to complement and inform the quantitative analysis that is the focus of most of our scope of work. The key issues identified during these interviews are as follows:

- *Different initial skill levels*: Nurses arrived at the trainings with widely varying levels of basic computer proficiency. While many participants used computers on a daily basis and were comfortable with basic computing concepts, some were unfamiliar with even basic actions such as how to use a mouse or to navigate through menu choices. Several trainers cited this as one of the biggest challenges during the training, as the lower-skilled participants required a lot of extra attention. This slowed down the pace of the classes, leading to frustration, boredom, and disengagement among the higher-skilled participants.

- *Difficulties in scheduling training sessions*: Designing a training schedule that allowed for all nurses to be trained in a short period of time while maintaining required coverage in each unit proved to be challenging, as the trainers had to account for vacations, sick days, staff turnover, etc.

- *Effectiveness of different training approaches for different types of trainees*: Several trainers expressed frustration regarding the web-based component of the training. Some felt that it was ineffective for lower-skill trainees, since the trainers ended up having to

repeat or clarify much of the information for these participants during the instructor-led session. However, trainers felt that for some higher-skilled participants, the web-based training would provide a good introduction and potentially reduce the need for some of the classroom-based sessions for this group.

- *Technical issues during roll-out affected follow-up training efforts*: Since the nurses' first usage of the new EHR system began hospital-wide on the same day that the system was implemented, trainers noted the initial difficulties in providing follow-up training while technical problems with the system were being resolved. Some elements of the system did not work smoothly as designed, leading nurses to become frustrated with trainers who could not resolve technical issues. This became less of a problem is the successive weeks as the system began to work as intended.

- *Apprehension about EHR systems*: Some nurses expressed apprehension about and resistance to the new system because they felt it would be used to monitor them more closely. Some also disliked the immediacy with which information must be entered into the system, as they were accustomed to being able to "catch up" on paperwork later in their shift.

- *Changes to workflow and other policies beyond record-keeping*: Trainers noted during the initial phase of EHR implementation that the use of the system had a cascading effect on other policies and procedures not directly related to the use of the system. This in turn required new training on the changes to work flow and procedures generated by the system.

The training personnel made the following suggestions regarding the design and implementation of EHR training programs in other hospitals making the transition from paper-based systems:

- *Sort trainees by initial levels of general computer proficiency*: Placing nurses with similar levels of computer proficiency in training sessions should allow for appropriately-paced classes to improve participant engagement.

- *Train in smaller groups for lower-skilled participants*: The standard session size of twenty was viewed by many trainers too large for all but the most skilled participants. Some trainers recommended that class sizes for trainees with lower levels of computer skills should be as low as ten participants.

- *Utilize training for higher-skilled participants*: The trainers felt that nurses with the highest level of existing computer skills would be the best candidates for web-based training, and that the best design would be a self-directed introductory module covering basic system usage, followed by instructor-led sessions.

- *Provide training close to the EHR roll-out date*: Due to scheduling requirements, the first groups of nurses were trained up to two months before the "go live" date for the system.

Some trainers identified this gap as negatively affecting learning retention and leading to additional needs for follow-up.

- *Changes to structure of training sessions*: While the 16-hour training length was generally viewed as adequate for most nurses, some trainers suggested breaking up the 8-hour sessions into 4-hour sessions over more days to facilitate participant engagement.

- *Provide opportunities for practicing with the EHR system*: Nurses were provided with limited opportunities to practice on a simulated version of the system; one trainer suggested that greater opportunities for self-directed practice with the system be provided.

- *Team teaching for class sessions*: Most of the trainers felt that the twenty-person class size was too large given some participants' needs for frequent individual assistance. The use of multiple instructors or assistants to provide one-on-one help during the sessions should allow the primary instructor to move through the training material more efficiently.

KEY RESEARCH ACCOMPLISHMENTS: The following are the key findings of our study:

- Our study found that the substitution of a web –based component for a portion of an initial EHR training course produced no measureable impact on training outcomes as compared to a fully classroom-based approach. There were no statistically-significant differences between the two training groups on two post-training tests of system knowledge, on supervisor-rated proficiency scores with the system following implementation, or on the amount of time needed for follow-up assistance. These findings did not support our hypothesis that nurses who receive web-based training as a substitute for part of the classroom-based training will show higher initial levels of knowledge of EHR system procedures. However, it should be noted that this change in the training model produced essentially the same results as the fully classroom-based model, which may have implications regarding reducing overall training costs as discussed in the Conclusions section below.

- On average, nurses needed about 53 minutes of follow-up training and assistance to achieve proficiency with the system. However, the amount of such training varied widely, with half of the nurses needing no additional training but others requiring as much as 9 hours.

- Our study found evidence to support our hypothesis that nurses with different personal characteristics require different levels of subsequent training and technical support in order to achieve EHR proficiency, and that nurses with higher levels of education and general computer proficiency will require fewer total hours of training and support.

- Two measures of pre-training computer skill levels – an indicator for daily computer use and a higher self-rating of computer skills – were consistently associated with less follow-up assistance, even when controlling for other factors such as age and education level. These may therefore be the most useful among the set of predictors tested for screening nurses for assignment into training courses of different levels of intensity.

- Increasing age was associated with higher levels of need for follow-up assistance in most models.

REPORTABLE OUTCOMES: At this point, our project does not have any of the listed reportable outcomes as we have just completed the final data analysis. We anticipate submitting an article for publication based on the results to an appropriate journal in the near future.

In the meantime, we submitted brief descriptions of our project and the results to *MD News* and the *Local Edge* which reach a variety of hospital personnel, physicians and others. Communicating through these outlets allows us to reach practicing professionals in positions to introduce our findings into their own organizations as they train staff on HIT, and specifically, EHR systems.

CONCLUSION: The findings of this study suggest a potential path to reducing the cost of training programs related to the roll-out of EHR systems within military (as well as civilian) hospitals. Our first key finding is that the substitution of a web-based component for part of the training curriculum as opposed to only utilizing standard classroom training had no measureable effect on training outcomes. The groups showed no statistically-significant differences on three different measures of initial knowledge/proficiency or in the number of minutes of additional assistance required after the initial training course. These findings did not support our hypothesis that nurses who receive web-based training as a substitute for part of the classroom-based training will show higher initial levels of knowledge of EHR system procedures. However, these results do imply that some part of the training could be delivered using web-based methods without affecting implementation outcomes, which should be less expensive than the delivery of classroom-based training. This may be particularly true for certain types of users, especially those who have higher levels of general computer proficiency prior to the training.

Though we did not measure the speed at which trainees completed the web-based component of the course, reports from the instructors indicated that some computer-proficient trainees completed these modules much more quickly than other participants. Since much of the expense of EHR training for nurses is related to the cost of paying trainees' hourly wages during training (which is likely to be at overtime rates since unit-level coverage must be maintained within the facility during the training), any approach that reduces the number of hours spent in training sessions should substantially reduce costs when multiplied across hundreds or thousands of employees. The added flexibility in scheduling training sessions provided by the web-based training may also generate cost savings by reducing the number of "backfill" hours required (in which another nurse must cover for a nurse in training to ensure sufficient coverage within the unit). Since the web-based training hours could be spread across shorter sessions on multiple days, this should reduce the need for such "backfill" scheduling during the training period.

Our second key finding - that nurses' characteristics are related to the amount of follow-up training needed - may also be used to guide the development and implementation of training and technical assistance programs. In our case, the hospital's training staff were largely left to their own devices in the design of the initial training program by the EHR vendor, whose staff was focused mainly on technical issues with the system as well as the provision of roving trainers during the post-"go live" period of system implementation. Since the switchover to an EHR system from a paper-based system is generally a unique event within a hospital, it is likely that the personnel charged with designing and delivering the initial on-site training will have limited knowledge of what to expect. Our findings suggest that rather than a "one size fits all" approach to the initial training, hospitals should vary the length and type of initial training based on their general level of computer proficiency. This factor appears to be a better predictor of success in achieving competency with the EHR system than other factors tested, including prior EHR experience and educational attainment. Smaller class sizes with multiple instructors for nurses with low levels of initial computer proficiency may also improve training outcomes and reduce the need for extensive follow-up assistance. Overall, targeted training programs based on initial screening for these factors could generate substantial cost savings in large hospital systems such as military hospitals as the nationwide transition and upgrades to EHR systems continues over the next few years. This approach could also continue to produce cost savings following EHR upgrades that require additional training.

REFERENCES: List all references pertinent to the report using a standard journal format (i.e. format used in *Science, Military Medicine*, etc.).

Berk, R. & MacDonald, J. (2007). Overdispersion and poisson regression. Journal of Quantitative Criminology, 24, 269-284.

McElduff, F., Cortina-Borja, M., Chan, S. and Wade, A. (2010). When t-tests or Wilcoxon-Mann-Whitney tests won't do. Advances in Physiology Education, 34(3), 128-133.

Thompson, T. G., & Brailer, D. J. (2004). The decade of health information technology: delivering consumer-centric and information-rich health care. Washington, DC: Dept of Health & Human Services.

Rind, D. M., Safran, C., & Phillips, R. S. (1994). Effect of computer-based alerts on the treatment and outcomes of hospitalized patients. Archives of Internal Medicine (154), 1511-1517.

APPENDICES: Attach all appendices that contain information that supplements, clarifies or supports the text. Examples include original copies of journal articles, reprints of manuscripts and abstracts, a curriculum vitae, patent applications, study questionnaires, and surveys, etc.

Sound Shore Medical Center
Health Technology Integration for Clinical, Patient Records and Financial Management Related to the Military

DATA FIELDS TO BE COLLECTED FROM EMPLOYMENT RECORDS REGARDING STUDY PARTICIPANTS

- AGE
- GENDER
- JOB TITLE
    - Registered Nurse
    - Clinical Nurse 1
    - Clinical Nurse 2
    - Clinical Nurse 3/Assistant Nursing Care Coordinator
    - Assistant Administrative Nurse Coordinator
- NUMBER OF YEARS EMPLOYED BY SSMC/MVH
- NUMBER OF YEARS OF NURSING EXPERIENCE
- EDUCATIONAL LEVEL (HIGHEST DEGREE COMPLETED)
    - Diploma
    - Associates Degree
    - B.S.N. or B.S.
    - M.S.N. or M.S.
- CERTIFICATION/LICENSE TYPE
    - R.N.

INITIAL SURVEY RE: COMPUTER LITERACY/EXPERIENCE

Thank you for taking this survey. This survey is part of a federally-funded research project which will measure the effectiveness of the Electronic Health Records system training and find ways to improve it in the future. Participation in the survey is voluntary. The information you provide will only be used in the evaluation of the effectiveness of the Electronic Health Record (EHR) training program. Your answers to these questions will not be used as part of employee performance evaluations and will not be provided to your immediate supervisor(s). The data provided to the researchers will not include any information which could be used to identify you.

The researchers are Social Policy Innovations, Inc. For questions regarding this research, please e-mail tbs203@gmail.com.

Your Identification Code _____

Please circle your answer for each of the following questions.

1. Have you ever received training in the use of an Electronic Health Records system?

Yes No

2. Have you ever used an Electronic Health Records system to record information regarding patient care?

Yes No

3. If yes, for how long did you use the Electronic Health Records system?

A. Less than six months

B. Six months to 1 Year

C. 1-2 years

D. 3-4 Years

E. More than 4 Years

4. Do you currently use computers as part of your work in the hospital?

Yes No

5. On a scale of 1 to 5, (with 1 being not sure how to turn a computer on, and 5 being very good), how would you rate your computer skills?

1 2 3 4 5

4. Do you use a computer at home?

5.

Yes No

6. Do you have access to the internet at home?

Yes No

See next page for last question.

7. How often do you use computers, including at work and at home (please choose the answer that is closest to the frequency of your computer usage)?

A. Never

B. Once per month

C. Once per week

D. Several times per week

E. Daily

Employee EHR Training Survey

Thank you for taking this survey. All responses will be anonymous and no attempt will be made to identify survey respondents. This survey is part of a federally-funded research project which seeks to determine the relative effectiveness of different types of training in the use of electronic health records systems. The survey will give the trainers and researchers a better idea about how successful the electronic medical records training was and ways to improve it in the future. Participation in the survey is voluntary, and the information you provide will only be used in the evaluation of the effectiveness of the electronic medical records training program. Your answers to these questions will not be used as part of employee performance evaluations and will not be provided to your immediate supervisor(s). The data provided to the researchers will not include any information which could be used to identify you. The researchers are Social Policy Innovations, Inc. For questions regarding this research, please e-mail tbs203@gmail.com

Basic information (circle or fill-in)

Hospital: Sound Shore Medical Center Mt. Vernon Hospital

Age: 18-24 25-34 35-44 45-54 55-64 65-74

Gender: Male Female

Education Level: B.A./B.S. Graduate/Professional

Years licensed in the medical profession: 0-2 3-5 6-8 9+

Native language: English Other

In your opinion, how good are your computer skills?

Very high High Average Low Very Low

Have you ever used an electronic health records system in another job?

Yes No

If Yes, for how many years? _____

Have you ever received training in the use of an electronic health records system in another job?

Yes No

Do you use a computer at home? Yes No

About the electronic health records *training at SSHS*

How long was your training (hours)? _____ **#** hours

Did part of your training involve web-based training?

Yes No

SEE NEXT PAGE

How much did you know about the electronic health records system *before* the training?

a lot a little nothing

How comfortable are you with the new system *after* the training?

very comfortable somewhat comfortable not at all comfortable

Please rate how you feel about the following statements (circle a number):

The old (paper records) system is more efficient.

Definitely		Not Sure		Definitely Not
5	4	3	2	1

The new Electronic Health Record system will result in better patient outcomes.

Definitely		Not Sure		Definitely Not
5	4	3	2	1

The new system will make my work easier.

Definitely		Not Sure		Definitely Not
5	4	3	2	1

I received adequate training on the new system.

Definitely		Not Sure		Definitely Not
5	4	3	2	1

My manager visibly commits to the implementation of the new Electronic Health Record system.

Definitely		Not Sure		Definitely Not
5	4	3	2	1

Information will be more completely recorded in the new system.

Definitely		Not Sure		Definitely Not
5	4	3	2	1

Information will be more accurately recorded in the new system.

Definitely		Not Sure		Definitely Not
5	4	3	2	1

I feel ready to use the new Electronic Health Record System.

Yes_____ No_____

SEE NEXT PAGE

Other questions

What is the most useful thing you learned in the training?

How could the training be improved to enable you to learn more about the electronic medical record system?

What else, if anything, would you have liked to learn about? Please give clear examples.

This test is part of our overall effort to ensure that nurses achieve competency on the new Electronic Health Record (EHR). Your answers to these questions will not be used as part of employee performance evaluations and will not be provided to your immediate supervisor(s).

We are also participating in a federally-funded research project which will measure the effectiveness of the EHR training and find ways to improve it in the future. Your participation in the research project is voluntary. Your answers will be provided to researchers who will not have any information which could be used to identify you. The information provided to the researchers will only be used in evaluating the effectiveness of the EHR training program.

Your Identification Code _____

Instructions: Please circle the one best answer for each question below. Each question is worth 2 points

1. Which of the following statements regarding SUNRISE CLINICAL MANAGER (SCM) security are true?

   A. Your assigned security gives you access to carry out functions in SCM.
   B. SCM records all of your actions. Every time you access a different chart section or whenever you make changes to the patient data, SCM logs that information and creates an audit trail.
   C. Every time you leave the computer, it is very important that you log off SCM otherwise, the next person to use SCM on that computer will be entering data under your name, and it will be logged in the audit trail as such.
   D. All of the above statements are true.

2. The Auto Log-Off Feature addresses:
   A. Infection control
   B. Security
   C. Power usage
   D. Physician liability

3. What information about a patient can be found in the Worklist Manager?
   A. Scheduled procedures, departmental tasks, and the MAR
   B. Patient location, demographics, and height/weight
   C. Allergies and Alerts
   D. Results and Health Issues

4. The three types of patient lists you can create are:
   A. Criteria based, Temporary, Special.
   B. Role based, Permanent, Location.
   C. Orders, Results, MAR
   D. Provider, location, Allergy

5. The list of patients in a specific location is an example of a:
   A. Special list
   B. Permanent list
   C. Temporary list
   D. Criteria-based list

6. What does the following icon in the Orders tab indicate? 
   A. All orders displayed are Active
   B. Orders are verified by the Pharmacy
   C. The view has been filtered
   D. All orders are displayed

7. To document that you have collected a urine sample for a culture, which action button in the Orders tab must be selected?
   A. Approve/Verify…
   B. Add Specimen…
   C. Release…
   D. DC/Cancel…

8. The Clinical Summary tab provides a view of which commonly used nursing document?
   A. Flow Sheet
   B. Nursing Kardex
   C. SOAP note
   D. MAR

9. What information must be entered and marked as reviewed prior to entering an order?
   A. Name
   B. Birth date
   C. Allergies
   D. Weight

10. In the Patient Info tab, you can **edit** what type of patient data?
   A. Allergies
   B. Demographics
   C. Health Issues
   D. Orders

11. Which of the following worklists can be viewed to find out when a patient's CT scan has been scheduled?
   A. Procedures- Consolidated
   B. Department Tasks-Consolidated
   C. MAR- This Pt by Order Set
   D. Nursing Tasks by Patient List

12. When entering a telephone order from a physician, which button on the Order Entry Worksheet must be selected?
   A. Requested by: me
   B. Requested by: other
   C. Patient allergy review
   D. Start of browse

13. A green flag will display in the Check Orders or New Orders column when:
   A. A routine order has been placed
   B. A STAT order has been placed
   C. Results are available

D. An order has been completed

14. To delete an incorrect order in the Review section of the Order Entry Worksheet which button can be selected?
    A. Edit
    B. Delete
    C. Copy
    D. Mark as done

15. Right-clicking in the time blocks on the MAR will allow you to:
    A. Delete the task
    B. Mark as done
    C. Cancel the dose
    D. View results

16. The Resuscitation/Care orders column
    A. Notes the presence of specific resuscitation care orders
    B. Allows you to view resuscitation orders
    C. Will display information such as “DNR/DNI”
    D. Is updated by the Physician

17. Which of the following Icons do you need to click to refresh the page?

A. 

B. 

C. 

D. 

18. By using the Right-click in the Orders tab or the Worklist Manager you can view:
    A. Order details and history
    B. Relevant results
    C. Drug interactions
    D. Patient Allergies

19. Patient Alerts can be viewed by double-clicking the:
    A. Patient’s name
    B. Flag in the Alert column
    C. Flag in the Check Orders Column
    D. Patient Header

20. How would you locate a completed CBC result in SCM?
    A. Ask the patient’s family members
    B. View the results under the Results Tab
    C. Call the lab to ask about CBC results

D. Look at the bedside flowsheet

Part II – Training Assessment: Nursing Order Entry

This test is part of our overall effort to ensure that nurses achieve competency on the new Electronic Health Record (EHR). Your answers to these questions will not be used as part of employee performance evaluations and will not be provided to your immediate supervisor(s).

We are also participating in a federally-funded research project which will measure the effectiveness of the EHR training and find ways to improve it in the future. Your participation in the research project is voluntary. Your answers will be provided to researchers who will not have any information which could be used to identify you. The information provided to the researchers will only be used in evaluating the effectiveness of the EHR training program.

Your Identification Code _____

Instructions: Using your assigned patient, complete the activities as outlined. Part II counts for 60 points toward your final score

Nursing/RN and LPN – Order Entry

Order Entry Activity 1: (6 pts total)

Scenario

Your patient, a 59 year old type 2 diabetic client (noninsulin-dependent) for 6 years, presented to his physician office with a non healing ulcer of 2 weeks' duration on his/her left foot. Screening tests done in the doctor's office revealed blood glucose of 346/finger stick and urine. Because of the distance from medical provider and lack of community services, he/she is admitted to the hospital. (***Note:*** *Your patient is not pregnant*)

Update to Patient Information

1) Create a manual list with your assigned patient.

2) Your patient reported that he/she is allergic to bees–with a reaction of Swelling/Edema.

3) Your patient is taking the following Home Medication: **Simvastatin 10 mg tablet, 1 tablet** daily.

Score:_____

Continued on next page

Order Entry Activity 2 : (24 pts total)

Douglass Ohio, the admitting physician, requested the following telephone orders:

1) **Gram's Stain** of foot ulcer; Source = skin; Site = foot**.**
2) **Blood Glucose** finger stick 4 times a day.
3) **CBC Next Draw**
4) **Electrolytes, next draw** and daily for 3 occurrences.
5) **Chest X-ray 2 View P A/ Lateral**- Current signs and symptoms= chest pain; requesting physician number = 712345
6) **ECG 12 Lead**- indication= Diabetes, requesting physician number = 712345
7) **Humulin N** Units= 10; route = SubCutaneous, frequency= morning and evening; begin insulin instruction for post discharge self-care
8) **Darvocet** –N 100 mg every 4 hours prn for pain.
9) **Diabetic diet - 2000-2200 calorie diet**—add note 3 meals/2 snacks; Dietitian consult (nutrition assessment, and education)
10) **Vital Signs** 4 times a day.
11) **Activity –** may be up in chair
12) Submit your orders and authenticate

Score:_____

Continued on next page

Order Entry Activity 3: **(14 pts total)**

Your patient had an acute Asthma attack during their hospital visit. Enter the following order on behalf of Douglas, Ohio (hint: tapering dose):

Enter the telephone order for Prednisone:

1) 40 mg every 12 hours x 3 days
2) 40 mg every day x 3 days
3) 30 mg every day x 2 days
4) 20 mg every day x 2 days
5) 10 mg every day

Orders Tab Review and Orders Management

1) Order Glucophage 1000 mg PO twice a day
2) Cancel the Humulin Insulin order.

Score: _____

Continued on next page

Order Entry Activity 4 : (12 pts total)

You have assessed your patients foot wound. Document the following:

a) Site = Foot

b) Irrigate With = Normal Saline

c) Cover With = Other

d) Comments/Instructions = Cover with wet to dry sterile dressing

Your patient is not responding to current wound treatment. The physician instructs you to:

1) Place an order for a **Wound Care Nurse Consult**.

2) Use the Orders Tab to discontinue/cancel the “Up in Chair” order because alternate treatment is necessary.

Score:_____

Continued on next page

Order Entry Activity 5 **(4 pts total)**

Scenario

Your patient has been admitted to the hospital with an infectious Disease. A "Notify Infection Control Nurse" consult order was placed.

Order Entry

1. Enter the Airborne Isolation (Precautious, Airborne) Standard Interventions order. The reason for Isolation= Shingles, Disseminated.

Discontinue Order

2. The MD has given you a telephone order that the patient's no longer needs isolation. Discontinue the isolation order

Score:_____

When complete, call the Instructor or TCE to verify your work.

Score:

Part I: _____

Part II: _____

Total: _____

Post Go-Live SCM Nursing Assessment

Nurse Name: _____

Nurse HB0 Code: _____

Unit: _____

Assessment Dt: _____

Assessment Completed by: _____

This test is part of our overall effort to ensure that nurses achieve competency on the new Electronic Health Record (EHR). We are also participating in a federally-funded research project which will measure the effectiveness of the EHR training program and find ways to improve it in the future. Your participation in the research project is voluntary. Your answers will be provided to researchers who will not have any information which could be used to identify you. The information provided to researchers will only be used in evaluating the effectiveness of the EHR training program.

Instructions:	Please use the key to assess each competeny statement: 5=independent 4=minimal assist 3=moderate assist 2= maximum assist 1= unable to demonstrate					
	Demonstrates ability to find a patient that is not on their unit list.	5	4	3	2	1
	Demonstrates ability to create/maintain personal patient list	5	4	3	2	1
	Demonstrates steps to turn on/off flags	5	4	3	2	1
	Articulates the purpose of new [orders, results, alerts and documents] flag and demonstrate clearing of the appropriate flag.	5	4	3	2	1
	Articulates the significance of the colors/shapes (ie red-square, green-triangle)	5	4	3	2	1
	Articulates the purpose of the to sign and to verify flags and is able to demonstrate co-signing and verifying orders.	5	4	3	2	1
	Demonstrates where patient allergy information is entered/stored.	5	4	3	2	1
	Demonstrates how to complete and discontinue an order.	5	4	3	2	1

Demonstrates the ability to enter a verbal medication order.	5	4	3	2	1
CONTINUED ON BACK OF THIS PAGE					
Demonstrates the ability to generate a lab label/collect a specimen for a given laboratory test	5	4	3	2	1
Demonstrates the ability to complete an admission profile (including the purpose of the !)	5	4	3	2	1
Demonstrates the ability to find information in a specific document (such as the H/P or progress note)	5	4	3	2	1
Demonstrates the ability to enter vital signs (including adding parameters and time columns)	5	4	3	2	1
Demonstrates the ability to discontinue vital signs/Intake & Output	5	4	3	2	1
Demonstrates the ability to enter Intake & Output.	5	4	3	2	1
Articulates the purpose of shift and daily totals, length of stay and blood balance totals.	5	4	3	2	1
Demonstrates the ability to enter observations on assessment/cares flowsheet (including adding parameters and time columns)	5	4	3	2	1
Articulates the meaning of WDL	5	4	3	2	1
Articulates the meaning of color on the eMar (both on the task description as well as a specific task instance.	5	4	3	2	1
Demonstrates how to mark a medication as done	5	4	3	2	1
Articulates when the “Mark as Not Done” and “Mark as Done by Other” selections should be used.	5	4	3	2	1
Demonstrates the ability to reschedule a single instance of a task	5	4	3	2	1
Demonstrates the ability to reschedule all instances of a task	5	4	3	2	1
Articulates when “Add a completed task” function should be used.	5	4	3	2	1
Demonstrates the ability to add a comment to an eMar task and a flowsheet observation	5	4	3	2	1
Articulates the purpose of the clinical summary tab. Articulates process for professional exchange handoff.	5	4	3	2	1
Demonstrates the ability to complete a patient discharge.	5	4	3	2	1

Total Score: _____

SEND COMPLETED SURVEY TO SUE McLEER (SSMC)
OR J R CANDA (MVH)

EHR TRAINING/TECHNICAL ASSISTANCE ROSTER

As part of a federally-funded evaluation of the nurse training program for the new Electronic Health Records (EHR) system, we are tracking the amount of technical assistance provided to each nurse after the completion of the classroom-based training sessions. Please record the following information each time you provide assistance with the use of the new system to a nurse.

Please note that the nurse's participation in the evaluation is voluntary. The information you provide is to be used only in the evaluation of the effectiveness of the EHR training program. The data provided to the researchers will not include information which could be used to identify the nurse or the trainer.

TRAINER: _____

EMPLOYEE NAME - please print	**EMPLOYEE DEPARTMENT**	**EMPLOYEE ID (HBO) NUMBER**	**DATE**	**NUMBER OF MINUTES OF ASSISTANCE PROVIDED**

SEND COMPLETED FORM TO SUE McLEER (SSMC) OR J R CANDA (MVH)

SOUND SHORE MEDICAL CENTER OF WESTCHESTER

"Health Technology Integration for Clinical, Patient Records and Financial Management Related to the Military"

W81XWH-10-2-0060

PERSONNEL

Title	Name
HIT Training Coordinator	Sue McLeer
Protocol Developer	Thomas Saunders
Assistant Evaluator	Thomas Saunders
HIT Training Consultant	Cary Steiner Sandra Wagner
Research Implementation	Janette Cooke
Data Entry Services	Thomas Saunders